U.S. Department
of Transportation

Federal Aviation Administration

Memorandum

Subject: **INFORMATION:** Installation Approval of Multi-Function Displays Using the AML STC Process; Policy Statement PS-ACE100-2002-002

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Revision A
(Adds Appendix A)

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To: SEE DISTRIBUTION

1.0 Introduction

1.1 What is the purpose of this Policy Statement?

This policy is to encourage use of the Approved Model List (AML) Supplemental Type Certificate (STC) AML STC approval process. It is designed to provide guidance to:

- FAA Engineers and Inspectors
- FAA Engineering and Airworthiness Designees
- Equipment manufacturers
- Aircraft modifiers
- Avionic equipment installers

1.2 What is the scope of this Policy Statement?

This policy focuses on the use of the AML STC for installation of multiple function displays (MFDs) in Civil Air Regulations (CAR) 3 or 14 CFR part 23 airplanes or sailplanes, balloons, or airships operating under part 91, and/or part 135 rules.

It does not introduce new policy or regulation but provides a compilation of existing regulation, guidance and procedures in the application of the AML STC process for certification projects. The AML STC process may be used whenever the ACO and applicant agree that it is appropriate.

The AML STC process may also be effective for a certification project of an aircraft under another certification basis such as Bulletin 7-A. The applicant should coordinate with the appropriate ACO for final determination.

1.3 What limitations are there on the MFD installation using this policy?

- MFD does not provide functions considered essential for continued safe operation.
- MFD does not provide information required by part 23 or CAR 3 or other predecessor certification rules or part 91 and/or part 135 operating rules.
- Normal operation or failure modes of MFD will not adversely affect systems providing functions essential for continued safe operation.
- The MFD only provides advisory information and does not provide a source for primary or required flight information. Advisory information is typically an aid to situation awareness, determination of system status, and reduction of pilot workload.

2.0 Approved Model List STC

2.1 What is an AML STC?

An AML STC approval process utilizes a single approval for STC to type certificated products that were originally approved separately. For example, an AML may list a Piper P-28 along with a Cessna 150, a Stinson 108, and so on. The AML is attached to the STC (FAA Form 8110-2) and lists the type certificated products eligible for installation of the STC and their respective FAA approved documents. Whenever a type certificated product is added or a document is amended, deleted, or added, the AML is revised and approved, not the STC. The AML revision process should be established during the initial AML STC certification. Reference FAA Order 8110.4B, Type Certification, chapter 4-2(a)(4) for more guidance.

The AML STC approval process develops a set of installation instructions that can be used to install equipment on several different type certificated products. These instructions include general installation guidelines and specific installation instructions.

The general guidelines reference standard practices and procedures such as electrical wire selection as specified in Advisory Circular (AC) 43-13. Due to the similarity of installation across the approved models, much of the installation instructions can be general in nature.

Specific installation instructions address more critical elements of the installation such as antenna placement. Specific instructions also address any specific installation differences between eligible models.

The STC with Approved Model List will be referred to as an AML STC throughout this document.

2.2 How do I begin the AML STC process?

The AML STC is a certification process and will require direct contact with the Aircraft Certification Office (ACO) engineering staff. To start a certification project, the applicant will submit FAA form 8110-12 to the geographically responsible ACO. A list of ACOs is contained in Appendix 7 of FAA Order 8110.4B. Additional guidance on the STC process can be found in Advisory Circular 21-40.

The applicant will be expected to submit their certification program plan following FAA Order 8100.5 paragraph 400.b.

An acceptable program plan is the Project Specific Certification Plan that is part of the Certification Process Improvement (CPI) approach. The applicant may also elect to use an alternative certification program plan method coordinated with the ACO.

2.3 Why use the AML STC certification approach for the installation of MFDs?

The use of an AML STC is beneficial to the FAA and the applicant when installing MFD equipment as it offers a streamlined method of approving multiple model installations. This method may reduce the number of follow-on approvals that would be required for additional airplane models. In addition, this method is intended to encourage the proliferation of advanced avionics into GA aircraft.

Generic installation instructions are used to install the equipment in multiple aircraft models under a single approved STC document. This results in less paperwork and workload to both the applicant and the FAA.

It is important that the applicant and the ACO agree to the use of this method early in the project. Together they should review the installation instructions to verify their applicability for the aircraft models requested along with conformity inspection and flight test requirements.

The AML STC approach streamlines certification in several areas:

- One STC provides a wide applicability list
- Master installation instruction set versus model specific instruction sets
- The number of conformity inspections is reduced
- The number of flight tests is reduced
- Additional models can be added without revising the original STC

2.4 How is revising the AML STC more streamlined than revising a standard STC without an AML?

If an existing STC contains an AML, the STC holder may add models to the AML through an approved revision process. The AML revision does not involve revising the entire STC, only the AML. This reduces the time and effort required to add models to the STC.

A procedure to revise the AML by the STC holder should be included in the original STC application. This ensures a method of revising the AML without revising the STC itself. The procedure should provide guidance on what engineering data will be required to add models to the AML along with any additional requirements for conformity inspections, flight or operational tests.

Any revision to the AML requires FAA approval.

An additional advantage is the ability to reduce or eliminate the need for conformity inspections for the model(s) added.

3.0 Background

3.1 What experience have we had using the AML STC process to install MFDs?

We have gained practical experience with the Alaska Capstone program in using the AML STC process as a method of approving MFD installation on a wide variety of aircraft under a single STC.

Alaska's Capstone program is a government and industry collaborative effort to improve operational safety through the deployment of safety enhancing airborne and

ground-based technologies. You can learn more about the Alaska Capstone program and review the AML STC documents at http://www.alaska.faa.gov/capstone/.

3.2 What have we learned from the Capstone program?

The Capstone program has demonstrated that a more streamlined approach for installation approval is appropriate for MFDs and will encourage installation by further reducing installation approval costs.

The AML STC approval method was used in Capstone. With this approach, the equipment manufacturer provides installation instructions valid for the airplanes for which approval is being sought. Thus, only one data set has to be reviewed by the FAA. "The FAA and Industry Guide to Avionics Approvals" provides additional discussion on the AML STC process.

4.0 Certification Plan Development

4.1 How do I develop a certification plan for an AML STC?

Currently, CPI provides a structured approach to the project management of a certification program. It describes how to plan, manage, and document an effective, efficient product certification process between the FAA's Aircraft Certification Service and applicants.

The FAA and applicants will use this process for Type Certification (TC), significant STC, and significant amendments to either TC or STC.

The process has two major parts:

- The Partnership for Safety Plan (PSP) establishes an early and formal written working relationship between the FAA and the applicant

- The Project Specific Certification Plan (PSCP) is meant to define and document a specific product certification plan between the FAA and the applicant to expedite a certification project under standardized procedures.

FAA Notice N8110.80 introduces the current CPI process and outlines how the process functions.

4.2 What guidance is there for developing a Partnership for Safety Plan and Project Specific Certification Plan?

The FAA, in coordination with the Aerospace Industries Association (AIA) and the General Aviation Manufacturers Association (GAMA), have introduced “The FAA and Industry Guide to Product Certification” and "The FAA and Industry Guide to Avionics Approvals."

These documents describe the design and production certification process for aircraft. They describe how to plan, manage, and document an effective and efficient product certification process. The FAA and the applicant should use these guides to develop the PSP and the PSCP for certification projects.

5.0 AML STC Considerations

5.1 What is involved with the equipment design approval of MFDs?

Basically, there are two steps: Design Approval of the equipment and Installation Approval of the equipment as installed in the aircraft.

Design Approval of an MFD is through issue of a Technical Standard Order Approval (TSOA) for the appropriate functions the MFD is capable of displaying) or meeting the requirements applicable to the equipment. Design Approval is needed because these systems may interface with other airborne systems and minimum requirements should be met to ensure proper operation without interference to other installed systems. Read FAA Order 8150.1A for further guidance on TSO procedures.

Installation Approval of non-required systems normally involves an installation review to verify the equipment will not adversely affect existing equipment to perform their intended function(s) or induce a hazard into the airplane.

A Functional Hazard Assessment (FHA) should be performed to identify and classify failure conditions including determining probable combinations of failures. Guidelines and reference materials that can be used in performing a FHA can be found in AC 23-1309-1C.

Section 5.2 discusses considerations for equipment design qualification. The applicant should discuss with the appropriate ACO personnel, early in the project, any requirements for equipment design qualification.

5.2 What are other considerations for equipment qualification

There are several industry and government references that address equipment qualification.

Industry Document References:

- RTCA Inc., Document DO-160D, Environmental Conditions and Test Procedures for Airborne Equipment.

- RTCA Inc., Document DO-178B, Software Considerations in Airborne Systems and Equipment Certification.

Note 1: You can get the above documents from RTCA Inc, 1828 L Street, NW, Suite 805, Washington D.C. 20036 (http://www.rtca.org).

- Underwriter's Laboratories Inc., Document UL 1418, Implosion Protected Cathode Ray Tubes for Television-Type Appliances. This document can be obtained from the Underwriter's Laboratories Inc., Publications Stock, 333 Pfingsten Road, Northbrook, IL 60062 (http://www.ul.com).

- Technical Standard Orders. If an applicable Technical Standard Order (TSO) exists, the equipment manufacturers must meet the minimum standards defined in the TSO. For non-required, situation awareness only equipment, an equipment manufacturer must specify the performance that the equipment is intended to meet. The equipment manufacturer may determine the environmental categories using DO-160D and the software categories using DO-178B. Notice 8110.92 provides guidelines for applying the RTCA DO-178B Level D criteria to previously developed software (PDS).

TSO-C113 defines the minimum performance standards for airborne MFDs. Any additional performance standards for multiple functions of the MFD such as terrain awareness information would require compliance to additional TSO requirements when applicable.

Refer to FAA Order 8150.1B for additional guidance on TSO procedures.

The equipment manufacturer should provide installation instructions including pin layouts, wiring diagrams and structural mounting means. If an antenna is required, the equipment manufacturer should provide the installation details for its installation.

The manufacturer should provide electrical load requirements for each piece of equipment to facilitate an electrical load analysis for the installation.

Only wire specifically designed for airborne use should be installed in aircraft. AC 43.13-1B provides acceptable guidance on selection of wiring to be used on aircraft. Choosing wire from AC 43.13-1B will permit wire approval without further showing including flammability requirements.

The primary electromagnetic interference (EMI) concern is that the MFD does not interfere electrically with any other installed equipment. EMI tests should conform to RTCA Document DO-160D.

Other installation considerations such as system interfacing and the use of software based systems should be addressed during the certification project to ensure the installation does not introduce conditions that could lead to degradation of those systems essential for continued safe operation.

The FAA has, and continues, to approve installations on a non-hazardous basis. The FAA's primary concern is that any device installed not interfere with any of the required equipment. A safety assessment conducted per guidelines outlined in AC 23.1309-1C will determine the acceptable level of safety required including Software Development Assurance levels.

FAA AC 23.1311-1A, Installation of Electronic Displays in Part 23 Airplanes, provides additional acceptable guidance for the installation of MFD equipment.

Any additional concerns regarding design approval should be discussed with ACO engineering personnel as part of the PSCP process.

5.3 What conditions should be met when developing an AML STC to install MFDs?

FAA Order 8110.4B, Chapter 4, provides the following guidance:

- STC data package consists of a principle design and certification data package for the change and either a master installation package for all eligible type certificated products or a separate installation package for each eligible type certificated product.

- Any design or installation differences between eligible products are identified in the design and installation data.

- Installation complexity is similar on all eligible products.

- The change does not require a substantial reevaluation of the type certificated product's airworthiness.

- The type certificated product flight or operational characteristics remain unchanged.

- The eligible type certificated products and FAA approved documents are listed on a special page known as the AML attached to the STC.

5.4 What considerations should be made when developing AML STC installation instructions?

Installation instructions for an AML STC must give adequate instruction for each approved airplane model. The installation procedure for this type of equipment should be similar from make and model of one aircraft to another.

The approach taken with the AML STC provides the installer with FAA approved installation guidance that is applicable to a variety of small airplanes. Any installation differences must be identified in the installation instructions including any issues about interfacing with other installed equipment.

The installation instructions should include procedures for determining the placement, installation, and post installation equipment checkout. Post installation check out procedures may include checking structural and electrical loads, external data source tests, software and database test, Electromagnetic Interference (EMI) test, altitude tests, magnetic heading interference test, interface test, and so forth.

In developing the installation instructions, the applicant may consult local avionics repair stations, the ACO, and Airworthiness Safety Inspectors from the FAA local Flight Standards District Office. Their assistance may provide insight about the information required for the installation instructions. The resulting AML STC should reduce the requirements of Flight Standards to issue follow-on field approvals for similar equipment installations.

5.5 What considerations should be made when developing an AML STC conformity inspection plan?

Conformity inspections are conducted to ensure that an aircraft component or modification conforms to the data submitted to the FAA and that the product being certificated complies with the Type design. These inspections physically compare the component or modification to the engineering specifications, drawings, and the airworthiness standards.

Experience shows that the requirement for conformity inspection of non-required equipment installations can be reduced in an acceptable manner. Depending on the airplanes listed on the AML, only one set of conformity inspections may be required.

The conformity plan should be well defined in the certification plan and must have FAA concurrence.

FAA Order 8100.4B and AC 21-40, Application Guide for Obtaining a Supplemental Type Certificate, provide more details on conformity inspections.

5.6 What considerations should be made when developing an AML STC flight test plan?

Flight testing may be necessary to verify that the system performs its intended function and does not adversely affect essential and critical systems. The flight test will generally be devoted to:

- evaluation of the pilot's ability to safely operate the equipment
- acceptability of the placement of the MFD equipment
- determination if equipment operation interferes with the operation of required systems
- determination if the equipment performs the intended functions

The AML STC should consider aspects of each eligible model to develop an approved test plan.

AC 23-8A, Flight Test Guide for Certification of Part 23 Airplanes, provides further guidance on flight test issues.

5.7 What are the Human Factors concerns?

A major concern is placement of the MFDs in the cockpit. They should perform their function without distracting the pilot from safely operating the aircraft. The FAA has recognized the need to address human factors issues along with pilot flight test evaluations due to the unique operational and pilot interface issues that require consideration.

The PSCP should include either a separate human factors plan or incorporate the human factors considerations in the overall certification plan. Guidance to assist in this effort along with other human factors considerations are contained in FAA Policy Statement PS-ACE100-2001-004. This document gives an overview of what should be included in a certification plan to address human factors considerations.

Additional human factors considerations can be found in GAMA Publication No. 10 which provides industry accepted guidance on human factors cockpit design for part 23 Small Airplanes. AC 23-1311-1A, TSO-C113 and the FAA and Industry Guide to Avionics Approvals also provide human factors guidance for MFDs.

5.8 Is an Airplane Flight Manual (AFM) supplement required?

A determination will need to be made if AFM action is necessary. This will depend on the need for limitations based on the equipment, operational complexity and the compelling nature of the MFD to draw the pilot's attention.

If it is determined that an AFM supplement should be developed, it needs to address the equipment limitations and operations. A generic supplement can be developed for all approved models. The generic supplement is then inserted into the existing flight manual with the cover page completed for make and model, registration number and serial number.

A dedicated AFM section should address any equipment operation limitations. For example, a MFD may be limited to "Situation Awareness Only" or "VFR Navigation Only. " The limitations are then stated in the flight manual supplement such as:

- Situation Awareness Only
- VFR Navigation Only
- Not approved for primary navigation

A placard near the MFD is an effective way of conveying limitations to the pilot.

The AFM is also the appropriate place to insert the operational instructions of the installed equipment. This information should give instructions to properly operate the equipment including any pre-flight test procedures, abnormal procedures and emergency procedure requirements. The AFM may also refer to equipment user manuals for more in-depth instructions on operating the equipment. Examples of instruction items include:

- Operators manual must be accessible to aircrew in flight
- Approved software revision status
- User manual status
- Required equipment placards

FAA AC 23-8A, Flight Test Guide for Certification of part 23 Airplanes, chapter 6, section 3, provides additional guidance on airplane flight manual and approved manual material.

Note 2: If the airplane does not require an AFM, a "Supplemental Flight Manual" should be developed to provide the same information.

5.9 What requirements are there for Instructions for Continued Airworthiness (ICA)?

An ICA is required as part of the AML STC data package. Part 21.50(b) states that a holder of an STC shall furnish at least one set of complete Instructions for Continued Airworthiness prepared in accordance with § 23.1529 Appendix G or § 31.82 Appendix A. Each appendix provides a checklist to assist in development of an acceptable ICA.

The ICA provides instructions necessary for certificated personnel to inspect and maintain the additional equipment installed by the AML STC per requirements of §§ 43.13(a) and 43.16.

The ACO engineer is responsible under § 21.50 for the compliance findings for requirements of the ICA as well as approving the airworthiness limitations section, if required. The Aircraft Evaluation Group (AEG) will assist the ACO engineer in establishing the adequacy of the ICA and determining the acceptability of the ICA.

The ICA must be in completed printed form when the first airworthiness certificate is issued, or before delivery of the first product, whichever is later.

FAA Order 8110.4B and Flight Standards Handbook Bulletin for Airworthiness (HBAW) 98-18 offers further guidance on the development of the ICA documents.

6.0 Reference and Guidance Material

- Advisory Circular (AC) 20-140, Guidelines for Design Approval of Aircraft Data Communications Systems
- AC 21-40, Application Guide for Obtaining a Supplemental Type Certificate
- AC 23.1309-1C, Equipment, Systems, and Installation in Part 23 Airplanes
- AC 23.1311-1A, Installation of Electronic Displays in Part 23 Airplanes

- AC 23-15, Small Airplane Certification Compliance Program, Section 4(v) provides guidance on accepted methods of performance evaluation of equipment installations

- AC 23-17, Systems and Equipment Guide for Certification of Part 23 Airplanes

- AC 23-8A, Flight Test Guide for Certification of Part 23 Airplanes, Chapter 5 provides guidance for performance evaluation of equipment and Chapter 6 provides AFM guidance

- AC 43.13-1B, Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair

- AC 43.13-2A, Acceptable Methods, Techniques, and Practices - Aircraft Alterations

- Order 8100.5, Aircraft Certification Directorate Procedures

- Order 8110.4B, Type Certification

- Order 8150.1A, Technical Standard Order Procedures

- Order 8300.10, Airworthiness Inspector's Handbook Volume 2, Chapter 1, Perform Field Approval of Major Repairs and Major Alterations

- Notice 8110.80, The FAA and Industry Guide to Product Certification

- Notice 8110.92, Guidelines for Applying the RTCA-DO-178B Level D Criteria to Previously Developed Software (PDS)

- FAA Policy Statement PS-ACE100-2001-004, Guidance for Reviewing Certification Plans to Address Human Factors for Certification of Part 23 Small Airplanes

- The FAA and Industry Guide to Product Certification January 1999

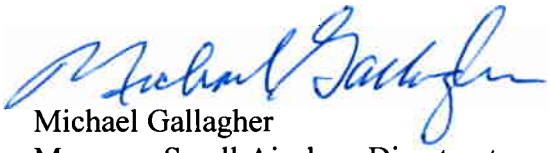
- The FAA and Industry Guide to Avionics Approvals April 2001

- GAMA Publication Number 10, Recommended Practices and Guidelines for Part 23 Cockpit/Flight Deck Design

- Flight Standards Handbook Bulletin for Airworthiness (HBAW) 98-18

These documents may be accessed through the FAA's website at (http://av-info.faa.gov).

If you have any questions or comments, please contact Mr. Barry Ballenger, by telephone at 816-329-4152, by fax at 816-329-4149, or by email at barry.ballenger@faa.gov.



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Appendix A. A Process for Approval of Multiple Function Displays that Provide Supplemental-only Navigation Information for Operations in IFR Conditions

1. What is the purpose of this Appendix?

To improve situation awareness, this appendix provides additional guidance to incorporate MFDs into small general aviation (GA) airplanes, which may be operating under Instrument Flight Rules (IFR).

Situation awareness, as used in this appendix, may consist of one or more of the following elements:

- Position awareness
- Weather awareness
- Traffic awareness
- Terrain awareness

2. What is the scope of this Appendix?

This appendix focuses on the use of the Approved Model List (AML) Supplemental Type Certificate (STC) for installation of multiple function displays (MFDs) in Civil Air Regulations (CAR) 3 or 14 CFR part 23 airplanes operating under part 91, and/or part 135 rules that may be operating under IFR conditions.

The appendix has been developed in coordination with Phase II of the Alaska Capstone program. The Capstone program uses the AML STC process to install an MFD for displaying Global Positioning System (GPS) supplied navigation information to improve situation awareness during IFR operations. The MFD may also be used for displaying weather, traffic and terrain information in the cockpit of small GA airplanes.

This appendix does not introduce new policy or regulation but provides a compilation of existing regulation, guidance and procedures in the application of the AML STC process for certification projects. The AML STC process may be used whenever the aircraft certification office (ACO) and applicant agree that it is appropriate.

3. What limitations are there on the MFD installation using this appendix?

- May display supplemental-only navigation information
- Normal or fail modes of the MFD do not adversely affect systems providing functions essential for continued safe operation
- MFD can not serve as an approved backup display for other primary flight information
- Aircraft has TSO-approved IFR instruments appropriate for facilities used for instrument procedures under § 91.205

4. What elements are involved in an IFR airworthiness approval for a specific navigation equipment installation?

The installation of GPS equipment (TSO approved) designed to provide navigation information for IFR operations is an extensive project and requires engineering and flight test evaluations to ensure integrity of the equipment. A typical IFR airworthiness approval project will typically involve the following elements:

- Lab/bench test and equipment data evaluations
- Aircraft installation data evaluations
- Ground test evaluations
- Flight test evaluations

AC 23.1311-1A, Installation of Electronic Displays in Part 23 Airplanes, offers additional guidance for installation of MFDs into GA airplanes.

5. What is involved with the equipment design approval of an MFD operating in an IFR environment?

This appendix considers that TSO design approval is applicable to all equipment required for IFR flight operations. The applicant could use other certification methods such as STC for equipment design approval but these methods will involve extensive engineering involvement.

The applicant may request deviations to the TSO minimum performance standards (MPS) by providing technical substantiation for the deviations requested. TSO deviations will require approval from Aircraft Engineering Division (AIR-100), as MPS is an AIR-100 responsibility. The applicant will normally coordinate any TSO deviation request through the cognizant ACO who will in turn coordinate with AIR-100 personnel.

TSO deviation procedures are described in Section 12 of FAA Order 8150.1 B, Technical Standard Order Program.

6. What levels of certification are required for software used in the installed equipment?

Section 23.1309(b) requires that installed systems, including system software, be evaluated by performing a safety assessment. A Functional Hazard Assessment (FHA) should be performed to determine the need and scope of the subsequent safety assessment. Guidance on the FHA and safety assessment can be found in AC 23.1309-1C.

To meet the acceptable safety level for equipment and systems objective of § 23.1309(b), Software Development Assurance Levels have been established for the four classes of part 23 airplanes. The FHA will classify the failure conditions that will determine the minimum Software Development Assurance Level requirements under Figure 2 of AC 23.1309-1C. Requirements for complying with each level are specified in RTCA DO-178B or its latest revision.

7. What additional considerations should be made when developing AML STC installation instructions for an IFR installation?

A major concern with a project using generic installation instructions is the determination that the instructions are adequate for all make/models included on the AML. A thorough review of the generic installation instructions will be required for each make/model to determine if any additional specific instructions will be required for specific make/model aircraft. The applicant should coordinate with the ACO staff on the method of determining whether the generic instructions are sufficient for all make/model airplanes included on the AML.

When additional airplane make/models are proposed for the AML, a thorough review of the installation instructions will be required to ensure the instructions are adequate for the additional models. This review must be coordinated with the ACO, as any revision to the AML requires FAA approval. The process may consist of a document review or may require evaluation of an actual airplane installation, depending upon the similarities to existing AML airplanes and the complexity of the installation.

Drawings and instructions should be reviewed to ensure they provide adequate information for installers to incorporate them into each make/model certified by the AML. Drawings depicting typical installation configurations can be useful to provide guidance on location within the airframe and in relation to other equipment.

Unless required, specific mounting locations may be generic to allow flexibility to the installer to select the best location based upon experience and the current configuration of the aircraft being modified. Issues specific to make/model airplanes (such as required location, routing of cables, electrical loads, and so forth) will be explained in the installation instructions.

Due to the increased importance of avionic components operating in an IFR environment, installation instructions to ensure proper operation and interface are a priority. Due to the nature of the MFD, it can be interfaced with multiple systems for display purposes. It is important that

the installation instructions provide adequate guidance on any interface included in the AML STC project.

If the system being installed requires a method of determining aircraft make/model to determine software/hardware settings or configuration, specific instructions must provide guidance regarding proper installation and operation for each aircraft make/model as required. Typical methods would include bussing pins or Electronically Erasable Programmable Read-Only Memory (EEPROM) containing program specifics as an integral component of the equipment installation rack.

Instructions must also contain any special installation considerations for mounting, location, cable routing, bonding/shielding requirements, lighting requirements, antenna placement, and so forth as determined by the equipment manufacturer and technical considerations. Generic references to documents such as AC 43.13-1B should be used sparingly; specific guidance should be provided for installation methods and practices. This provides a single source for installation information and can reduce the chance of an improper installation.

Installation instructions must contain post-installation ground and flight test procedures to determine that the installed equipment is operating properly. These test procedures should be specific and allow personnel to determine the equipment is functioning per approved data.

The flight test should be conducted in Visual Flight Rules (VFR) weather conditions. The flight test should verify that the installed system does not interfere with equipment essential for continued safe operation. Proper operation of the installed equipment should also be checked to verify that other equipment operation does not adversely affect it.

Installation instructions must include the procedures for installing and verifying software for the installed equipment. Examples of software include navigation database, terrain database, obstruction database, and application software. The instructions must include a method of determining that the software load was successful.

A method of determining the current software revision status must be included. Procedures for updating or revising the installed software including mandatory periodic database revision under the Aeronautical Information Regulation and Control (AIRAC) schedule must be included.

8. What additional considerations should be made when developing an AML STC conformity inspection plan?

Conformity inspections are required to ensure that the product being certificated complies with the type design. It is the responsibility of FAA engineering personnel to request conformity inspections.

Due to the more critical nature of IFR equipment installations, additional conformity may be required when detailed instructions for a specific aircraft make and model are required in addition to the generic installation instructions. This decision will be determined by ACO engineering.

9. What additional considerations should be made when developing an AML STC flight test plan?

Flight-testing will be necessary to verify that the system performs its intended function and does not adversely affect essential and critical systems. A functional ground and operational flight test must be conducted in VFR conditions, to verify proper functioning of all equipment installed by the AML STC. The flight test will generally include:

- Evaluation of the pilot's ability to safely operate the equipment
- Determination if equipment operation interferes with the operation of other required systems
- Determination if the equipment performs the intended functions

Additional flight test evaluation guidance can be found for GPS installations in AC 20-138, Airworthiness Approval of Global Positioning System (GPS) Navigation Equipment for Use as a VFR and IFR Supplemental Navigation System.

The AML STC should consider aspects of each eligible model during the flight test plan development. Any concerns unique to the make/model should be addressed in the flight test plan.

10. Is an Airplane Flight Manual (AFM) supplement required?

An FAA approved appropriate AFM supplement (or, for aircraft without an FAA Approved Flight Manual, a Supplemental AFM) will be required for each installation. The proposed manual should contain the following information regarding the installation:

- General description of the installed system (may be referenced to a pilot’s guide for installed equipment)
- Equipment operating limitations
- Normal procedures (may be referenced to a pilot’s guide for installed equipment)
- Emergency/abnormal operating procedures

A generic AFM supplement or supplemental AFM may be used but if make/model specific information is required, it must be incorporated into the affected make/model supplement as required.

11. What requirements are there for Instructions for Continued Airworthiness (ICA)?

The AML STC must meet the requirements of § 23.1529 and FAR 23 Appendix G for ICA. The ICA must contain any instructions for periodic maintenance requirements such as cleaning, functional checks, and so forth. The ICA must also contain any calibration requirements, procedures, or instructions necessary to maintain the equipment in a continued airworthiness condition.

Approved methods and procedures for software revisions or updates must be included in the ICA. Procedures must include any appropriate equipment required along with a method to verify that the software load was successful. Also, the ICA must include a method to verify software revision status.

If software revision loading cannot be accomplished, the system may not be considered functional. In some cases, the Minimum Equipment List (MEL) procedures may allow dispatch with some equipment inoperative. In case software part number/revision level cannot be verified, the MEL should specify whether the affected equipment may be disabled and aircraft allowed to be returned to service.

For example, for part 91 operations, if the database has expired, the pilot in command may continue a flight with an expired database, if the database information for the flight can be verified with current and approved aeronautical charts and does not fly Area Navigation (RNAV) GPS approaches or instrument departure procedures/approaches with an expired database. The pilot shall have the database updated at the first opportunity. Part 135 operations may involve additional restrictions.

If the installed equipment incorporates a system of identifying aircraft make/model to the installed hardware/software such as bussing pins or EEPROM, the ICA must contain detailed information on the proper operation and installation of this system. The ICA must include a method to verify when the system is operating properly and to allow a functional check to determine the identification of make/model to the installed hardware/software.

Troubleshooting procedures to box level components must be included. Wiring diagrams must be included to assist in troubleshooting. The ICA must contain adequate procedures to remove and replace each component within the system and include the appropriate return to service test. The return to service test must be adequate to determine the installed component is capable of operating per design and is airworthy for IFR operations.

When any maintenance is performed on the system, maintenance personnel must be required to verify software part number configuration before and after maintenance is performed on the airborne equipment.

The ICA must also include procedures for any required periodic testing requirements to meet compliance with regulations for IFR operations or specific flight rule operations.

12. What considerations should be made concerning Minimum Equipment List (MEL) development?

A MEL allows an aircraft operator to dispatch the aircraft with specific items inoperative while still meeting regulatory requirements for safe and appropriate flight under § 91.213. The MEL is a precise listing of instruments, equipment, and procedures that allow an aircraft to be operated under specific conditions with inoperative equipment. Procedures are included to instruct either operation personnel (flight crew) or maintenance personnel to take appropriate actions before or during operation with the listed equipment in an inoperative condition.

Although the MEL is an operations issue, the STC applicant should consider both the technical and operational issues during certification that would allow continued operation of the aircraft with their equipment in an inoperative condition. By including guidance in the data package for equipment that can be inoperative and procedures to be accomplished to allow continued operation with inoperative equipment, the operator can then include the incorporated STC equipment in their MEL for improved dispatch capability.

Guidance for MEL approval can be found in:

- FAA Order 8700.1, General Aviation Operations Inspector's Handbook, for operations under part 91 rules; and

- FAA Order 8400.10, Air Transportation Operations Inspector's Handbook, for operations under part 135 and part 121 operations.

These orders provide guidance to both Aircraft Evaluation Group (AEG) personnel and the Principal Operation Inspector (POI) to administer the MEL process.

AEG is the point of contact for aircraft certification and is responsible for the development, revision and publication of the Master Minimum Equipment List (MMEL) for each aircraft within their areas of responsibility.

The FAA maintains MEL information on the World Wide Web at www.opspecs.com.

13. What is required to return the aircraft to service once the STC is approved and installed?

Any U.S. registered product modified by an AML STC will be required to be returned to service by means approved by FAA Flight Standards policy and guidance.